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# Isolating cochlear synaptopathy in people with impaired audiograms: An auditory brainstem and envelope-following response modeling study

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## ABSTRACT

Listeners with impaired audiograms likely suffer from mixtures of peripheral hearing pathologies that include outer-hair-cell loss and the more recently discovered cochlear synaptopathy. These mixed pathologies pose challenges for current audiological practice as objective brainstem EEG metrics might not be able to isolate these different hearing deficits. By simulating different degrees of outer-hair-cell and auditory-nerve fiber loss in a functional model of the human auditory periphery, we studied which auditory brainstem (ABR) and envelope-following response (EFR) measures and stimuli are most sensitive to either type of hearing deficit. We validated our model predictions using recordings from 32 listeners with normal or elevated hearing thresholds. The simulations show that high-frequency outer-hair-cell loss steepens the ABR wave-V latency-vs-intensity curve as well as the wave-V amplitude-vs-intensity curve, such that grouping listeners according to the ratio of these metrics (i.e., the ABR growth ratio) offers a way to factor out the outer-hair-cell aspect of hearing loss. Individual differences within an ABR growth ratio group are sensitive to other aspects of peripheral hearing loss such as cochlear synaptopathy. We furthermore simulated EFRs to pure-tone and broadband stimuli of different modulation depths to study which EFR metrics are sensitive to synaptopathy in hearing impaired listeners.

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